XCYCLE’s innovative measures to increase cycling safety: Infrastructure and human factors

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Outline

• Cyclists fatalities in Europe
• The XCYCLE project
• XCYCLE results
• Conclusions and open issues
Cyclists’ fatalities in Europe

- **2,015 cyclists fatalities** on EU roads in 2016 (+0.3% in respect to 2015)
- 58% inside **urban areas**
- 20% F and 80% M

28% of all bicycle fatalities happens at **junctions**

XCYCYLE:
Advanced measures to reduce cyclists' fatalities and increase their comfort in the interaction with motorised vehicles

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#1: Traffic safety analysis

- Analysed main factors contributing to Bicycle-Motorised Vehicle (B-MV) collisions.

- Identified key features of cyclist crashes using latent class analysis and association rule mining (data on B-MV crashes from 10 European Countries)

- Employed decision tree technique to assess the relationship between severity of bicycle crashes and specific factors

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#2: Road users’ behaviour analysis

- Analysed errors and violations among cyclists and how traffic infrastructures might reduce unsafe behaviours

- The role of perceived competence, risk perception, unsafe behaviours and cyclists’ anger in cycling near misses

- How journey attributes and the evaluation of motorists’ behavior affect crash occurrence and severity


#3: HMI and acceptance of ITS

- A driving simulator in Leeds has been programmed with common cycle-to-truck conflict scenarios.

- A set of HMI recommendations has been derived covering both visual and acoustic aspects.

- We identified major determinants of acceptance of PCDS + EBR and On-bike collision warning system with prototypes


Negative impact on the potential safety effect of a ITS system by overreliance, distraction or annoyance of the system
#4: in-vehicle and on-bike system

- **In-truck** Cyclists blind spot detection and collision warning
- **On-bike** UWB localization and collision warning system
#5: Infrastructure-based systems

- **Adaptive traffic controller** algorithm in "green wave for cyclists" in Groningen

- **TraffiTowers** in Braunschweig, extracting video recordings and trajectory data with real time risk assessment.

- **Amber light**: We predict critical situations between right-turning motorists and crossing cyclists then send signal with different level of criticality


#6: Integration and evaluation of the systems

- **Braunschweig**: behavioural evaluation at the AIM intersection with different users
- **Groningen**: observation of cyclists' behaviour, assessment of gaze behaviour
- **Multi-country study on “Willingness to pay”** among European cyclists (N = 2381)
- **Qualitative study with truck drivers and cyclists** on XCYCLE systems (using VR)
- **Cost-benefit analysis** to give a broad perspective of the project impact

Successful integration and testing activities in Braunschweig!
Conclusions

• Innovative and cost-effective solutions
  → to promote sustainable mobility
  → Need to find way to support large scale deployment (business cases, new vehicle
  standards, ...)

• Complete segregation (expensive and unfeasible) < Social integration and inclusion
  (e.g. urban shared spaces). Technology can support it.

• Grouping and platooning cyclists through traffic control systems (e.g., green waves)
  → increase safety and reduce unsafe behaviours.

• Trust, perceived safety, and attitude toward technology → most important correlates
  of behavioral intention to use the systems
Open issues and next steps

• A constantly evolving road environment:
  - New vehicles (PMV, electric, connected and automated, ...)
  - Need to pro-actively define new interactions between road users (e.g. VRUs and AVs) → VRUs risks to be neglected.
  - Address underreported and under-investigated dangerous traffic situations (e.g. near-misses)

• Adopting a pro-active strategy → measures and not counter-measures.

Need to adopt “evidence-based” SPI (safety performance indicators) to:
→ Increase transparency

Need to strengthen co-operation between all stakeholders (asset-management, municipalities, police, schools, ...)
Thanks for your attention!

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